CLAIMS

Claimed is:

1. An apparatus for performing low coherence ranging of a sample with high transverse resolution and large depth of focus, comprising:

a. an optical ranging system comprising

i) a light source,

ii) a means for directing light from said light source to said sample,

iii) a means for directing reflected light from said sample to a detector,

iv) at least one detector,

v) a means for processing light data received by said detector and which generates an image; and

b. an optical element having

i) a transverse resolution defined as Δris less than or equal to about 5 μm, and

ii) a depth of focus Δz of at least about 50 μm.

2. The apparatus of Claim 1, wherein said light source is a broad spectral content light source.

3. The apparatus of Claim 1, wherein said light source is a pulsed laser.

4. The apparatus of Claim 1, wherein said light source is a continuous wave laser.

5. The apparatus of Claim 1, wherein said means for directing light to and from said sample is an interferometer.

6. The apparatus of Claim 1, wherein said means for directing light to and from said sample is optical wave guide lens.

7. The apparatus of Claim 1, wherein said means for directing light to and from said sample is optical fiber lens.

8. The apparatus of Claim 1, wherein said detector is a single detector.

9. The apparatus of Claim 1, wherein said detector is an array of detectors.

10. The apparatus of Claim 1, wherein said processor is capable of analyzing interferometric data.

11. The apparatus of Claim 1, wherein said processor is capable of analyzing temporal detection.

12. The apparatus of Claim 1, wherein said processor is capable of analyzing spectral analysis.

13. The apparatus of Claim 1, wherein said optical element is an axicon lens element.

14. The apparatus of Claim 13, wherein said optical element is transmissive.

15. The apparatus of Claim 13, wherein said optical element is reflective.

16. The apparatus of Claim 13, wherein said optical element is refractive.

17. The apparatus of Claim 13, wherein said optical element is an apodized lens.

18. The apparatus of Claim 13, wherein said optical element is a hologram.

19. The apparatus of Claim 13, wherein said optical element is a combination of a diffractive element and a lens.

20. The apparatus of Claim 13, wherein said optical element is a combination of an apodized lens, a hologram and a diffractive element.

21. An apparatus for performing low coherence ranging of a sample with high transverse resolution and large depth of focus, comprising:

a. an optical ranging system comprising

i) a light source,

ii) a means for directing light from said light source to said sample,

iii) a means for directing reflected light from said sample to a detector,

iv) a detector;

b. a means for processing light data received by said detector and which generates an image; and

c. an optical element that produces a plurality of focused spots that are distributed in depth.

22. The apparatus of Claim 21, wherein said plurality of focused spots are in a straight vertical line.

23. The apparatus of Claim 21, wherein said plurality of focused spots are at an angle with respect to said vertical plane.

24. The apparatus of Claim 21, wherein said plurality of focused spots has a different longitudinal location.

25. The apparatus of Claim 21, wherein said optical element is an axicon lens element.

26. The apparatus of Claim 25, wherein said optical element is transmissive.

27. The apparatus of Claim 25, wherein said optical element is reflective.

28. The apparatus of Claim 25, wherein said optical element is refractive.

29. The apparatus of Claim 25, wherein said optical element is an apodized lens.

30. The apparatus of Claim 25, wherein said optical element is a hologram.

31. The apparatus of Claim 25, wherein said optical element is a combination of a diffractive element and a lens.

32. The apparatus of Claim 25, wherein said optical element is a combination of an apodized lens, a hologram and a diffractive element.

33. The apparatus of Claim 21, further comprising means for producing multiple object spots, such that each spot has a unique distance from its origin to said optical element such that the image of each spot has a unique longitudinal location.

34. The apparatus of Claim 33, wherein said multiple spot generation means comprises multiple optical fibers.

35. The apparatus of Claim 33, wherein said multiple spot generation means comprises aperture mask

36. The apparatus of Claim 33, wherein said multiple spot generation means comprises diffraction grating

37. The apparatus of Claim 33, wherein said multiple spot generation means comprises microlens array

38. The apparatus of 21, further comprising a means for scanning said means for directing light to and from said sample.

39. The apparatus of 21, further comprising a means for scanning said light.

40. The apparatus of Claim 38, wherein said scanning means is a scanning mirror.

41. The apparatus of Claim 38, wherein said scanning means is a means for moving the fiber with respect to said optical element.

42. The apparatus of Claim 38, wherein said scanning means is a means for moving both said fiber and said optical element.

43. The apparatus of Claim 38, wherein said scanning means is a means for moving the beam emanating from said optical fiber.

44. The apparatus of Claim 38, wherein said scanning means is a means for changing the angle of the beam with respect to said optical elements.

45. The apparatus of Claim 21, further comprising a sheath for enclosing said apparatus.

46. The apparatus of 21, further comprising a means for scanning said axial focus

47. A method of obtaining a high resolution and high depth of focus image of a sample, comprising:

a. providing a light source;

b. directing light from said light source through an optical element to a sample by a light directing means;

c. receiving reflected light from the sample back through said optical element;

d. directing said reflected light to a detector; and,

e. processing the data from the detector to produce an image,

wherein said optical element has transverse resolution of less than 5 μm and a depth of focus of greater than 50 μm.